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Editorial

Should internet sites be mentioned in the bibliographies of scientific publications?

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In the 19th century, when a long-gone optimistic attitude towards the future of our civilization was prevailing, science was seen as a permanent process of increase of our positive, rational knowledge, not only in the aim of being able to act more efficiently, i.e. to improve our technical mastership, but also in the hope of getting a more comprehensive basic understanding of all aspects of the world we live in, by pure intellectual curiosity. At that time, it was considered of utmost importance to maintain a permanent link between all historical periods of development of science: any new finding, any new theory, was placed in this historical context and was viewed as the addition of a new stone to an edifice to the building of which all scientists of the past had contributed. Times have changed, and many scientists have now adopted a much more limited scope in their activity, either by being only interested in the development of scientific knowledge having predictable, and often immediate, practical applications, or by feeling only concerned with recent findings and theories, without including them in a more general apprehension of the evolution of scientific knowledge. The fact that, quite recently, a paper using (in a specific context, that of zoological nomenclature) a formula like "tyranny of the past" to qualify this permanent link between current and previous science, has been accepted for publication by different scientific journals (SAVAGE, 1990a-b, 1991), is an interesting illustration of this trend.

The laboratory in the Paris Museum where I have been working for thirty years is on the other side of a street bordered by two major French Universities, and in the last decades I have not infrequently found, in the dustbins of the latter, piles of journals, especially those, like *Nature* or *Science*, which, being published weekly, represent a large volume of paper each year; questioned about this, researchers or librarians of these Universities would reply that their laboratories or libraries are too small and lack space to store important amounts of scientific literature, and that furthermore, after a certain time has elapsed, these publications have become "obsolete" and are no more "useful" for ongoing research: for this latter reason, they did not even think useful to query, before throwing these publications away, if other scientific laboratories or libraries would be interested in recovering them. Clearly, for a number of scientists nowadays, scientific publications have become a short-term-use product, like many other products in our society. That this attitude has strong influences on the course of scientific research itself is hardly to be demonstrated: never before has scientific research more slavishly followed fashions, with some dominant ideas, techniques, methods or research subjects being supported or explored by many researchers and teams during a decade or two, and then completely abandoned when other more recent ideas or subjects supplanted them in the fund-raising systems of science, and, by way of consequence, in the minds of many.

Such a way of functioning of science may be very efficient whenever science is viewed merely as a way to produce more efficient or cheaper pharmaceuticals, pesticides, cosmetics, computers, cars, satellites or weapons, i.e. as a basic support to technical improvement, but it may not be so if science is also understood as aimed at a better understanding of the world we live in, irrespective of any aim at acting upon it or at modifying it. If science is to be a progressive construction of a complex corpus of knowledge, i.e. of facts and theories about these facts, it is highly questionable

whether any scientific publication ever becomes "obsolete": it is part of a complex edifice, and suppressing or ignoring it may be like removing a stone at the basis of a wall. Stating that current science can be understood and mastered without connection with the past of science is similar to saying that the architecture, painting, music or literature of the past are now "obsolete" and should be forgotten or destroyed to replace them by the works of our time.

In some scientific fields, the progress of research is so quick, and the competition between researchers, research teams or even countries so strong, that many new results or theories, at the time when they are published, are already "obsolete", in the sense that they are already known of several other researchers and teams. In such research fields, it is striking that the bibliography of a paper often contains many references to works quoted as "personal communication", "unpublished data", "work in progress", "in preparation" or "in press". Of course, this may cause problems later if subsequent authors wish to trace these "phantom publications", which not rarely happen not to have ever been actually published after having been quoted (see DuBois, 1999): hence the recommendation, which is even an editorial rule in some periodicals, not to mention such "references" in a bibliography. The same problem applies to the growing practice consisting in quoting internet sites as bibliographic references in scientific papers or books. In fact, such references are of the same nature as a "personal communication": in the future, they won't be available to readers of the publication where they are quoted. An internet site has no permanency, as it can be modified, "updated", "corrected" or suppressed at any moment. No long-term trace is usually kept of what was available on a site at a given date, and even if such a memory is kept privately by the owner or editor of a site, it is not directly available to customers.

The function of a list of "references cited" at the end of a scientific paper is double: (1) to provide the sources of information used by an author to support some of the scientific statements considered in the paper as valid or discussed in the paper; (2) to allow any reader of the paper to go back personally to these sources and to study them exactly as they were when they were quoted. In order for a bibliography to be useful, all references that appear there should be accessible to any reader, and should remain so in the future, whatever the fate of the authors of the works or of the paper where these references appear. This condition does not apply to works quoted as "personal communication" or "in press" (except if the precise reference of the future publication can be provided with certainty), and similarly does not apply to internet sites. The problem here does not come from internet sites being on a support other than paper, but on their having no permanency. Some non-paper publication systems, such as CD-Roms, audio or video cassettes, can be as permanent and non-modifiable as paper publications, and qualify for "publications" that can be quoted in a bibliography: for this reason, such works can be considered as publications for the purposes of the *International Code of zoological Nomenclature* (ANONYMOUS, 1999), which is not the case of internet sites.

No one knows what will be the long-term fate of our society, of the activity we call science and of the corpus of results and theories produced by this activity. However, as soon as a scientific periodical places itself within the frame of long-term science, "as if science was still to exist for many decades and centuries", it should care for publishing only bibliographic information that will be available for readers in the long-term future. For this reason, the periodical *Alytes* does not accept the mention of internet sites among the references listed in the *Literature cited* section of a paper. If absolutely necessary for the understanding of the text, or to provide some information that would not be available otherwise, exceptional mention of an internet site in the corpus of the text may be acceptable, just like in some cases it is acceptable to mention a "personal communication" or "unpublished data". But this reference won't be repeated in the bibliography. In most cases, information that may *today* be easier to find on an internet site may also be available in paper-published works: although it may be a little more time-consuming for an author to trace such a published information, mention of such a published reference will, in the long run, be much more useful to the future readers of the paper and is worth the effort to find it.

For the same reason, i.e. the need of a long-term accessibility of all the information mentioned in the papers it publishes, the journal *Alytes* does not put a priori limitations on the length of papers or of tables of data and results of scientific works submitted to the journal: "*Alytes* encourages the publication of complete tables of original data, that can be used by subsequent authors for further analysis or critical reevaluation, rather than simply providing results of statistical tests, phylogenetic analyses, etc." (DuBois, 1997: 188). This also means that *Alytes* does not encourage authors to state that additional detailed data are available at their address and can be obtained by writing directly to them, or are available online (e.g., as "supporting online material"): what will be the fate of such pieces of information in 50 or 100 years? Either this information is useful for the understanding of the paper and evaluation of its merits, and then it should be included in the paper (even as a long table or appendix), or it is not, and then it should not be mentioned at all.

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